CAMBRIDGE SYSTEMATICS

Limited Amendment TranPlan 21 to Comply with SAFETEA-LU: Draft Policy Statement and Supporting Background Material

Task 2.6 – Visualization Techniques

Draft

Report

prepared for

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Draft Supporting Background Material – Visualization Techniques

This draft report presents a discussion of the SAFETEA-LU provision requiring states to use visualization techniques in the process of developing long-range transportation plans (LRTP) and state transportation improvement programs (STIP). Sections presented in this report include SAFETEA-LU requirements, the Montana Department of Transportation's (MDT's) experience using visualization techniques in support of the *TranPlan 21 2002 Update* and other planning and programming efforts in Montana, and an introduction to how visualization techniques will be used to support this Limited Amendment of *TranPlan 21*.

■ SAFETEA-LU Requirements

The SAFETEA-LU rule includes the following new definition and requirement for visualization techniques:

- **23 CFR Section 450.104 Definitions**. Visualization techniques means methods used by States and MPOs in the development of transportation plans and programs with the public, elected and appointed officials, and other stakeholders in a clear and easily accessible format such as maps, pictures, and/or displays , to promote improved understanding of existing or proposed transportation plans and programs.

- **23 CFR Section 450.210(a)(1)** - The State's public involvement process at a minimum shall: (v) To the maximum extent practicable, use visualization techniques to describe the proposed long-range statewide transportation plan and supporting studies; (vi) To the maximum extent practicable, make public information available in electronically accessible format and means, such as the World Wide Web, as appropriate to afford reasonable opportunity for consideration of public information.

The emphasis in the legislation is on strengthening public participation by making LRTP and STIP information more accessible electronically and easier to understand. While many states have extensive experience in using visualization techniques for specific projects, fewer states have experience in using visualization and electronic methods (such as the World Wide Web) to convey information about transportation plans and programs. A variety of visualization techniques that state DOTs can consider using, range from simple illustrations and charts to sophisticated simulation tools. Options for conveying this information electronically may include the web, specific project web sites, newsletters, among others. The statute is not prescriptive in the types of visualization that should be used and states could select those techniques and electronic methods that are effective for their purposes. For example, the use of flow charts to explain the planning process is a

simple and effective application of visualization. Appropriate tools according to SAFETEA-LU requirements may include:

- Artist renderings;
- Computer modeled images;
- Computer simulation;
- Drawings;
- Flowcharts;
- Charts/Graphs;
- Interactive GIS systems;
- Maps;
- Models;
- Photo manipulation;
- Scenario planning tools;
- Simulated photos;
- Sketches;
- Videos; and
- Visual preference surveys.

Visualization techniques include on-line information, maps, and links to documents of draft and final plans, reports, corridor studies, and web-based lists of projects in a STIP. Further information about visualization including noteworthy practices can be found at the FHWA web site (http://www.fhwa.dot.gov/planning/vip/index.htm).

■ MDT's Use of Visualization in Ongoing Public Involvement

MDT uses a variety of visualization techniques in their public involvement process to help illustrate and explain concepts and information related to statewide planning, corridor planning, and programming. MDT uses visualization tools such as maps, graphs, charts, drawings, pictures, flow charts, and other data to support a variety of public and stakeholder outreach activities, plans, and projects. This information is largely conveyed using the electronic methods, including the MDT web site, specific links to statewide plan and corridor project web sites, as well as hard copy and electronic presentation material.

Many of MDT's planning documents can be found on the MDT web site http://www.mdt.mt.gov/publications/brochures.shtml) for brochures, publications, and study reports.

MDT Databases, Web Sites, and Other Visualization Techniques

MDT supports the following statewide planning and programming efforts using the following visualization techniques, with outputs of many of these techniques available to stakeholders and the public using electronic methods:

- **Geographic Information Systems (GIS) Database -** Through its Road Inventory and Mapping Section, Traffic Data Collection Section and Information Systems Division, MDT maintains and operates a Geographic Information System database that contains a variety of statewide transportation, economic, and behavioral data used to support plans and programs and the public involvement processes associated with these studies. The comprehensive roadway network layer can be combined with other available information, such as travel demand data, to produce GIS-based maps (electronic and hard copy). MDT generates and uses these GIS-based maps for statewide plans such as the *2002 TranPlan 21 Update* and corridor studies conducted across the state. Upon request, MDT generates and provides this information to various project sponsors, stakeholders, and/or the public. For example, upon request, tentative construction maps, display boards to support corridor projects, displays to show construction projects on a corridor (most common request), displays to address environmental information and issues, among many others have been produced by MDT for use as visualization techniques for planning or other specific planning efforts. Over 90 percent of the requests MDT responds to are for a project sponsor or the general public.

- **Transportation Information System (TIS) Photo Log and Image Viewer -** MDT has developed and maintains two separate tools representing Montana's roadway network. The TIS Photo Log is used by MDT to provide and display general infrastructure related data for the statewide roadway network including system, roadway length, width, pavement type, last reconstruction date, among other characteristics. MDT has provided these photo-logs in support of public involvement meetings for specific corridor studies, legal disputes, and safety system assessments. MDT has also developed a visualization tool called the Image Viewer. This tool provides images of the on-system highway network in ten-meter increments. While the TIS Photo Log and Image Viewer are separate tools, MDT will be working towards integrating them into a common, separate tool for on-going visualization use and data application.

- **State Road Map** – Through its GIS, MDT distributes the State Highway Map that is the most widely used visualization product produced by the agency with over 1,000,000 maps produced annually.

- **Traffic Data for Bicycles Map** – MDT produces and distributes a statewide on-system bicycle map for use by the general public and includes traffic volumes, road grades, shoulder widths and rumbles strip locations.

- **Traffic Flow Map** – MDT produces a traffic flow map for all statewide rural on-system roadways distributed through the internet that includes daily traffic volumes for all statewide roadways. The traffic volumes entered into this map are static and updated once a year and used to provide annual traffic data.

- **Interactive Sources –** MDT maintains web site links to other public agency web sites related to transportation systems for public and stakeholder access. For example, MDT provides a web site link to the metropolitan planning organization (MPO) and other community plans.

- **Before and After Maps** – MDT prepared and presented before and after maps to the public that graphically show the results of improvements undertaken by the department. For example, before and after pictures showing improvements made to rest stops (as part of MDT's ongoing efforts to restore and renovate rest stops across the state) have been shown to the public to identify the potential benefits of these improvements to other locations.

- **Biennial Survey** – As described later in this report (under *TranPlan 21* below), MDT has conducted and distributed biennial public involvement and stakeholder surveys to obtain public input and feedback on a variety of transportation issues and attitudes. This survey is also being used currently to support this Limited Amendment of *TranPlan 21* to identify potential ways in which to improve MDT's process for communicating plans and programs to the public. MDT will use the results of survey to design a process to better meet the visualization needs of ongoing and future public involvement methods.

- **MDT Web Site -** The MDT Web Site is a visualization tool that can be accessed and used by stakeholders and the general public to obtain standard maps of traffic flows and other related characteristics upon request.

Public Involvement in Support of Statewide Planning and Programming

MDT publishes a public involvement brochure that is used to explain the periodic and ongoing public involvement process in their statewide transportation planning and programming processes. This brochure uses pictures, maps, and charts to help explain planning and programming within the public involvement process. MDT has specifically designed this process for statewide planning and programming in support of periodic updates to *TranPlan 21* and the STIP. Outside of this process but using some of the same processes and visualization techniques, MDT develops separate and unique public involvement processes for individual corridor plans.

This process includes routine MDT staff contact with Montana's stakeholders and the general public. Stakeholders consider transportation planners, engineers, and decision-

makers at the local (city/town), regional (county/Metropolitan Planning Organization), and state levels; interest groups at each level such as bicycle and pedestrian, economic development, environmental, freight, and public transportation agency partners; community leaders, and tribal governments. Specific example s of how MDT's public involvement process supports *TranPlan 21* and the STIP are presented below.

TranPlan 21

The 2002 update of *TranPlan 21*, the state's comprehensive multimodal transportation plan, considered several focus areas including Economic Development, Access Management, Roadway System Performance, Travel Safety, Public Transportation, Bicycle and Pedestrian Transportation, and Land Use Planning. This Plan, and its predecessor in 1995, was developed in large part using an extensive public involvement process involving a variety of visualization techniques to obtain input and feedback from stakeholder groups and the general public. This public participation process implemented to support *TranPlan 21* is now being used by MDT on an ongoing basis to support statewide and corridor transportation planning initiatives.

TranPlan 21 included supporting public involvement objectives such as development and implementation of:

- A customer-driven plan;
- Inclusive techniques;
- Structured process designed to obtain feedback early on in the Plan development process, prior to major plan decisions, and to help refine and finalize the plan elements;
- Opportunities for underrepresented groups to participate; and
- Opportunities for on-going communication by elected officials, MPOs, tribal governments, other stakeholders, and the public.

The objectives of this plan were carried out in three Stages including:

Stage I – MDT conducted the first Stage of public involvement after the preliminary definition and identification of issues and trends, before developing the policy goals, actions, and alternatives. This Stage was implemented to inform the public of the *TranPlan 21* update process, obtain input identifying and refining issues and concerns, and build plan support. Newsletters, targeted telephone, mail-out, and email surveys, open houses and stakeholder forums, tribal government meetings, local government association meetings, among other techniques were implemented by MDT as part of this Stage.

Stage II – This Stage was implemented after the alternatives for policy goals, actions, and plan alternatives were prepared but prior to the preparation of the Draft *TranPlan 21* documents. This Stage was implemented to obtain feedback about alternative policy

goals and actions. Similar techniques as implemented in Stage I were used including newsletters, targeted email and mail-out surveys, open houses, focus groups, and tribal and local government meetings.

Stage III – This Stage of the public involvement process was implemented after the release of the Draft *TranPlan 21* documents but prior to finalizing the report. This was the last opportunity provided to stakeholders and the public to provide input and feedback on the Draft Plan before finalization. Draft Plan material was disseminated to public libraries for stakeholder and public review and comment. Summaries of the Plan were also available upon request through the U.S. mail and email.

The techniques implemented in all three Stages, and in particular those in Stage I, were designed by MDT to use some combination of in-person meetings and electronic information to provide stakeholders and the public alike with the opportunity to obtain feedback and provide input in the *TranPlan 21* planning process. The Stage I public participation techniques in the *TranPlan 21* update relevant to meeting SAFETEA-LU requirements included:

TranPlan 21 Online Community. This online database of stakeholders and interested individuals was established by MDT as a link to the MDT Web Site. Stakeholder input was solicited and obtained through this technique at key decision points in the planning process. This tool was used to form the basis of the stakeholder database used to support *TranPlan 21*. It has continued to grow since its initial development and is currently being used to support a variety of statewide transportation planning activities in Montana.

Public Opinion Surveys were implemented to support the 1995 *TranPlan 21* and MDT continues to refine and use these surveys on a biennial basis to support statewide transportation planning in Montana. For this Amendment, MDT added a series of questions about *TranPlan 21* and Montana's long-range transportation planning process.

Various other techniques that were applied in Stage I included newsletters and targeted surveys that stakeholders were able to access and submit input either electronically or by mail. In addition, MDT's presentations to government associations, MPOs, tribal governments, stakeholder organizations, as well as the focus groups and open houses implemented by MDT included a wide variety of visualization techniques that are still being used by MDT to support long-range transportation planning.

Ongoing Long-Range Transportation Planning

In addition to the specific techniques developed and applied to support the latest *TranPlan 21*, MDT uses a variety of visualization techniques to support on-going planning efforts. These planning efforts include:

- Annual meetings to discuss implementation status, to determine high priority actions;

- Annual reports of the status of *TranPlan 21's* policy goals, actions, information and successes;

- Biennial telephone and stakeholder surveys; and

- On-going public involvement elements such as newsletters, toll-free information and comment lines, focus and advisory groups, press releases and advertisements, procedures to provide input to the STIP, special mailings, local and tribal government involvement processes, and transportation workshops and conferences. MDT releases four regular newsletters: an aeronautics newsletter, *Montana and the Sky*; the Disadvantaged Business Enterprise Newsletter; the Rail, Transit, and Planning Division newsletter, *Newsline*; and research newsletters.

Each of these planning efforts is supported, as appropriate, by visuals such as photographs, artist renderings, charts, and graphs. These are used to describe or explain MDT activities that are underway. The MDT web site is a communication tool used to provide a variety of on-line communication to the public to support long-range planning (including *TranPlan 21)* such as postings of current and past newsletters, division publications, a variety of maps, press releases, traffic counts, and final *TranPlan 21* documents and policy statements. MDT also posts the program delivery status reports, the final STIP, information on various projects and studies on its web site for public access. MDT used presentation techniques such as power point and video along with display boards, pictures, and maps to help the public more easily understand planning and programming. Figure 1 shows a map used by MDT to support the access management element of *TranPlan 21* and Figure 2 shows a photo used to illustrate roadway conditions.

Statewide Transportation Improvement Program (STIP)

The Statewide Transportation Improvement Program (STIP) is MDT's statewide, annual work plan of multimodal projects. Produced annually, the STIP lists most major multimodal transportation projects that are funded by federal and state programs for a three-year period.

As with *TranPlan 21* and on-going long-range transportation planning efforts, MDT's development of the STIP is largely dependent on stakeholder and public input. MDT uses similar processes and visual techniques and the electronic distribution of material for input and feedback to support the public involvement process for the STIP as described above for *TranPlan 21*. For example, the MDT web site can be used by stakeholders and the public to access the STIP and to understand the project delivery status. The STIP includes tables and charts depicting sources and allocation of funding for that period. In addition, the locations of projects included in the STIP are shown on individual maps for each district. Additional tools such as periodic press releases describing both the completion and status of the draft and final STIP and toll-free telephone numbers are used by MDT to solicit input from those interested in the development of the STIP. For example, the draft STIP is provided, either on the MDT web site or in consultations with local agency staff for public review and comment. MDT carefully considers these comments and incorporates them into the decision-making process and provides maps of the STIP's project locations along with the schedule of the improvement.

Figure 1 – 2002 *TranPlan* 21 Update Map showing Access Controlled Corridors

Access Controlled Corridors

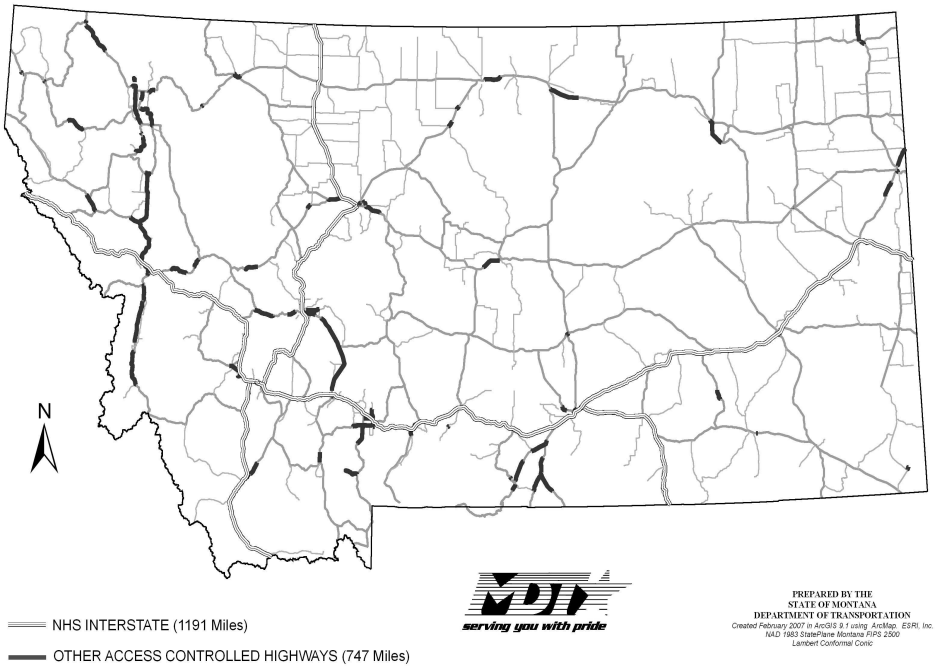


Figure 2 Example of Photo used to Support the Public Involvement Process

Corridor Studies

TranPlan 21 recommends MDT establish and prototype a process and guidelines for developing corridor-level strategies to address reconstruction needs. With this recommendation MDT plans to conduct corridor-level studies on facilities at capacity to analyze the need for improvements. This process is used to inform the NEPA /MEPA process and help eliminate alternatives to be studied and define the purpose and needs statements used during NEPA/MEPA. The corridor planning process is anticipated to reduce the cost of the environmental process, speeds project delivery, and provides early involvement of environmental interests, regulatory agencies, and the public. The corridor plans also address broader issues than traditional environmental analysis such as land use planning and socioeconomic conditions. The corridor planning process complements the NEPA/MEPA process and ensures decisions are made at the appropriate level, considers low-cost alternatives, and available funding. MDT will continue to use this corridor planning process to support *TranPlan 21* and state and corridor-specific planning other efforts.

Visual displays and information regarding each corridor study can be found on the MDT web site. MDT produces and distributes a variety of maps to describe the corridor studies including maps showing the highway corridor and the communities along the corridor. Also, MDT maps and displays key data such as traffic data, crash data, environmental, affected wildlife, among a variety of other visual information in support of each corridor study. Figure 3 shows the location of the MDT's Montana Highway 78 corridor study. MDT has implemented a public involvement process for this corridor study that has included a variety of methods. Two newsletters were produced and distributed to stakeholders and the public in June and September of 2006. These newsletters included the following information:

- June 2006 newsletter – MDT described the MT 78 Corridor Study process, area, and purpose. Additional information about how corridor studies are conducted and detailed information about the scoping process, development of corridor goals, issues, and deficiencies, identification and evaluation of potential improvement options, and selection of feasible and recommended options were included in this newsletter. Information about how stakeholders and the public could participate in this corridor study through email, mail and other means were also presented.

- September 2006 newsletter - Similar information presented in June 2006 describing the corridor study was presented in this newsletter. Detailed information was presented about the preliminary improvement options identified by MDT, its consultants, and stakeholder and public participants. In support of this newsletter, MDT provided detailed aerial photos of the corridor that also depicted potential geographical, roadway design, and other issues associated with various alternative options.

Two separate rounds of public meetings were also held to support the MT 78 Corridor Study with more planned as the study progressed. The first public meetings included scoping sessions in locations along the MT 78 corridor. Stakeholder and public input considered a variety of design issues such as traffic speeds and traffic flows, sight distance hazards, and steep slopes, among others. The second round of public meetings considered obtaining input from stakeholders about the goals and objectives of the study. Input was also obtained about MDT's preliminary set of potential improvement options for the corridor. Visual displays of information (display boards and PowerPoint presentations) were used in both rounds of public meetings.

MDT provided a direct link from its home page to the MT 78 Corridor Study web site for stakeholder and public access. The newsletters are posted on this web site including a variety of other information including the project schedule, an overview of the public involvement process, suggestions in which other stakeholders and the public could participate in the process, among other items. In addition, MDT provided an electronic comment/request form linked directly to the web site for ease of stakeholder input. MDT also has developed and used a variety of analytical tools to support the technical analysis, public meetings, and newsletters. Electronic and hard copy maps were produced by MDT describing the corridor and the potential improvement options for implementation in the corridor. In particular, the QUANTM software was applied in this study to help define potential corridors in the study area that addressed a variety of environmental, engineering, cost, and community issues and concerns. Through QUANTM's geographic interface, information can be displayed to assess environmental constraints, corridor alignment constraints and issues, and other transportation planning performance indicators for transportation corridor planning. This powerful tool was used to produce a variety of corridor maps of alternative options that addressed these issues and was used by MDT to present these corridor options to the stakeholders and public. The resulting analysis generated by QUANTM will be continued to be used by MDT to present information to the stakeholders and public and equally be effective in helping to identify the most feasible alternative option for the corridor.

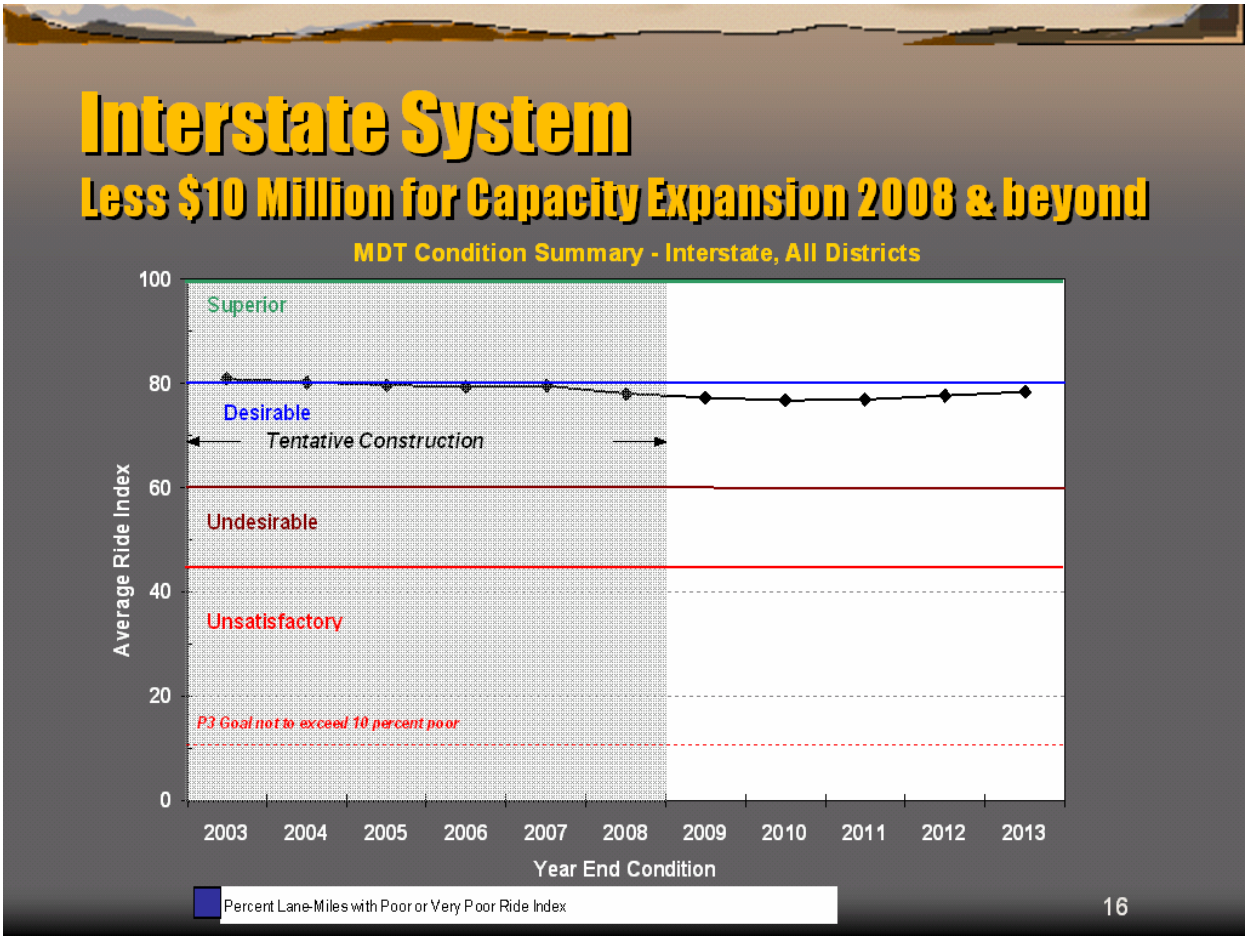
Figure 3. Montana 78 Corridor Study Location

Performance Programming Process (P³)

MDT uses computer-based management systems, through the Performance Programming Process (P³), that assist in summarizing and managing the condition of the transportation system and evaluating the impacts of various investment options. These systems are used in managing highway pavements, roadway congestion, bridge conditions, and safety; and are supported by an annual data collection program.

P³ allows MDT to assess how well it is meeting the goals developed in *TranPlan 21.* This asset management based approach to programming helps MDT determine the appropriate investment mix between types of work (reconstruction, rehabilitation, and preservation) to optimize system service life, safety, and mobility. In support of P³, performance measures were developed and are used to track closely with *TranPlan 21* goals and then it is used to provide an annual assessment of how well those goals are achieved. For instance, MDT has an objective to maintain and improve congestion levels through improving system operations within urban areas. This includes funding intersection improvements, signal synchronization projects, and directing funding towards pavement preservation projects. These types of actions together result in a much better managed system. Figure 4 shows a slide of from the *2004 P3 Analysis for the 2009 Funding Year*.

Figure 4. Slide from *the 2004 P3 Analysis for the 2009 Fiscal Year*



MDT is currently using P³ to support current planning and programming, and will continue to be refined and used by MDT to support transportation planning, policy, and the Limited Amendment of *TranPlan 21*. The P³ brochure and displays of performance measures developed and distributed by MDT uses visualization to illustrate the relationship between *TranPlan 21*, STIP and programming, funding, and project delivery and performance. This brochure also includes a chart that shows how performance measures fit into the decision-making process.

Highway Economic Analysis Tool (HEAT)

The Highway Economic Analysis Tool (HEAT) was developed by MDT to assess the transportation system and cost effectiveness potential of highway corridor improvements of various types across the State. HEAT provides a rigorous analysis capability to evaluate, measure, and compare the effectiveness of corridor capacity, management, and operations enhancements and strategies. Performance or user benefits related to safety (improved crash rates), environmental (reduced air emissions), and transportation (reduced delay and improved mobility), among others, are built into HEAT to assess the benefit/costs of corridor improvements.

HEAT, because its performance and economic analysis models are linked to both statewide economic (Regional Economics Model, Inc. – REMI) and passenger and freight travel demand models, also can be used to assess the future transportation corridor impacts relative to economic growth. MDT continues to refine and use HEAT to support ongoing transportation planning and policy analysis as part of the Limited Amendment of *TranPlan 21* and other statewide and corridor initiatives.

HEAT, because it is GIS-based, offers a wide variety of visualization techniques and displays that can be used by MDT to support analysis conducted for *TranPlan 21* and various corridor studies. Graphic displays of transportation and economic oriented performance indicators can be produced and distributed by web site and provide MDT with a wealth of graphical information that can be displayed through both statewide and corridor-specific public involvement purposes.

Tentative Construction Plan

The Tentative Construction Plan is MDT's five year plan that identifies the allocation of funds by category and MDT district. Prepared annually, this plan is fiscally constrained, and covers the allocation of funds that are allocated to the five MDT districts by program category. MDT uses various charts and graphs in this document to show progress, status, and to compare funding to actual expenditures.

Comprehensive Highway Safety Plan

In support of the development of the Montana Comprehensive Highway Safety Plan (CHSP), MDT provides on-going public involvement using various techniques such as newsletters, website, and opportunities for public comment via the internet, telephone or in writing. The newsletters, accessible through the MDT web site, contain maps, pictures, and graphs to illustrate findings and information (http://www.mdt.mt.gov/publications/newsletters/newsline.shtml). For example, the December 2006 Newsletter summarized MDT's Comprehensive Strategic Highway Safety Plan and utilized a graph to compare the Montana fatality rate to the U.S. fatality rate.

■ Draft *TranPlan 21* Policy Amendments

The public involvement processes and techniques presented above and developed and implemented by MDT, continue to be used by the agency to strengthen stakeholder and public participation for statewide and corridor transportation planning in Montana. The techniques developed by MDT have evolved over time to be more effective and comprehensive, and have helped MDT provide electronic-based and graphically-oriented visualizations and detail about specific projects to convey to the participating stakeholders and public. MDT has found that these visualization techniques have provided stakeholders and the public with an effective means to interpret and understand complex technical or spatial information and project results. These techniques, as they have evolved over time, have been used by MDT to convey existing conditions, interpret data, provide a common understanding of project goals and improvement options, and

facilitate a comprehensive evaluation of impacts and benefits of existing versus proposed plans.

The SAFETEA-LU planning regulations require the use of visualization techniques in the public involvement process to help describe the proposed long-range transportation plan and supporting studies. The specific techniques are not prescribed other than examples that include maps, pictures, and/or displays. MDT currently makes extensive use of visualization to support both long-range planning and programming in their public involvement process. It is not envisioned that MDT needs to do anything extraordinarily different to meet this requirement in this Limited Amendment of *TranPlan 21*. However, MDT will need to continue to follow the development of new and innovative visualization techniques as they are used by other states and developed by the Federal Highway Administration (FHWA) and the Transportation Research Board (TRB). Based on these developments and where applicable, MDT will continue to explore the use of new visualization techniques and innovative interactive tools to conduct statewide planning, programming, and public involvement. Whenever necessary, MDT will update its official public involvement processes to incorporate these tools and techniques.